

MITIGATING CLIMATE CHANGE CHALLENGES IN NIGERIA FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

This paper discussed the climate change, its challenges and ways of mitigating the climate change challenges in Nigeria in order to enhance sustainable development using secondary data. It also reviewed the causes of climate change in two categories; natural and manmade. The effects of the climate Change were equally reviewed. The paper concluded that there is need for commitment towards ensuring and adopting healthy, friendly strategies to adapt to the climate change challenges for sustainable development. The paper recommended that Nigerian government and all the stakeholders involved in the global phenomenon needs to increase public awareness, promote research and establish a commission or an agency that will handle issues related to global warming and climate change.

KEYWORDS: Climate Change, Health, Solar Variation, Mass Migration and Insecurity

INTRODUCTION

The average pattern of weather, called climate usually stays pretty much the same centuries if it is left to itself. However, the earth is not being left alone. People are taking actions that can change the earth and its climate in significant ways. As a result gasses known as Green House Gas (GHG) are emitted into the atmosphere and cause global warming. After nearly two decades of skepticism, climate change is now in front burner as the primary environmental threat of the 21st century, it has even been in the political agenda as never before (Oladipo, 2008)

Climate change is no longer a distant possibility but a current reality (World Bank, 2010).The impacts and consequences have the potentials to wipe out development gains and significantly reduce the standard of living (Ujah, 2009) The adverse effects of climate change on human health, means of livelihood, agriculture, employment and others are becoming rampant that if nothing is done about it, it may be too late to save the earth for man's habitation and also for the future generation. The world is now at alert trying to establish the best policies and practices that will cut down drastically the greenhouse gas which is making the earth warm.

CLIMATE CHANGE

Climate Change goes deeper than generally known term as climatic variability which means variation in the mean state and other statistics of climate on all spatial and temporal scales beyond that of individual weather event. Such temporal scale variations could be monthly, seasonal, annual, decadal and periodic. Climate change is of two facets namely

global warming and global cooling. Global warming is a gradual but systematic increase in average global temperatures experienced for a very long period of time while the reverse is true for global cooling. According to Intergovernmental Panel on Climate Change (IPCC, 2007), it shows that the current warming of the earth's climate is unequivocal caused by anthropogenic forces as is now evident from observations of increases in global average air and ocean temperatures. If the current warming continues unabated for period, it will attain a new climate status- warm or hot climate- with its effects on man and the ecosystem.

A drastic change in the climate systems either due to natural forces or unsustainable human activities results in climatic change. The latter is regarded as the basic cause of on-going climate change and the advanced countries are most responsible (De Weerdt, 2007). The observed climatic data from developed countries reveal significant change in many physical and biological systems in response to global warming but there is lack of data and literature on observed changes in developing countries (IPCC, 2007).

Causes of Climate Change

The cause of climate change can be divided into two categories- natural and manmade. The natural causes include;

- **Solar Variation**

This is observed when the energy output of the sun increases and atmospheric composition changes, with the oxygenation of the atmosphere being the most notable alteration by the increase in the green house gases.

- **Volcanic Eruption**

Volcanism is a process of conveying material from the crust and mantle of the Earth to its surface. Volcanic eruptions and hot springs are examples of volcanic processes which release gases and / particulates into the atmosphere. When a volcano erupts, it throws out large volumes of sulphur dioxide (SO_2), water vapour, dust and ash into the atmosphere. Although the volcanic activity may last only a few days, yet the large volumes of gases and ash can influence climate patterns for years. Millions of tones of SO_2 gas reach the upper levels of the atmosphere (stratosphere) from a Major eruption. The gases and the dust particles partially block the incoming rays of the sun, leading to cooling. Sulphur dioxide combines with the water to form tiny droplets of sulphuric acid. These droplets are so small that many of them can stay aloft for several years and are carried around the atmosphere bringing about cooling. This phenomenon has been experienced in Philippine when there was eruption from Mount Pinatubo in April 1991 (Miller, 2006)

- **Continental Drift**

The discovery of fossils of tropical plants (in the form of coal deposits) in Antarctica has led to the conclusion that this frozen land at some time in the past, must have been situated closer to the equator, where the climate was tropical, with swamps and plenty of lush vegetation ⁽⁷⁾. This drift also had an impact on the climate because it changed the physical features of the landmasses, their position and the position of the water bodies. The separation of the landmasses changed the flow of Ocean currents and winds, which affected the climate.

- **Ocean Variability**

The Oceans are a major component of the climate system. They cover 71% of the Earth and absorb about twice as

much of the sun's radiation as the atmosphere or the land surface ⁽⁸⁾. Ocean currents move vast amounts of heat across the planet-roughly the same amount as the atmosphere does. Ocean currents have been known to change direction or slow down the most abundant greenhouse gas on Earth. Yet, water vapor also contributes to the formation of clouds, which have an impact on the climate, as is believed to have happened at the end of the last Ice Age about 14,000 years ago (Gray, 2009).

Human Causes of Climate Change

Since 1800s, when people began burning large amounts of coal and oil, the amount of carbon dioxide (CO₂) in the earth's atmosphere has increased by nearly 30%, and average global temperature appears to have risen 1° and 2° F (Obunwo and Braide, 2013). Carbon dioxide in the gas traps solar heat in the atmosphere, partly in the same way as glass traps solar heat in a sunroom or a green house. As more carbon dioxide is added to the atmosphere, solar heat has more trouble getting out. This shows that if everything else stays unchanged, the average temperature of the atmosphere would increase.

Burning of fossils fuels such as coal, oil, natural gas for electricity generation, steel making, car exhaust, etc.); release greenhouse gases (CO₂, CH₄, NO₂) which are major factor in climate change. Methane levels in the air are high especially in this era of industrialization. Methane could be also released from digestive process of cattle, microbes in paddy field, coal mines, natural gas pipelines, burning of industrial wastes and landfill sites (Ekere, 2013). Massive felling and burning of the tropical rain forest is the second largest source of carbon dioxide accounting for 20-25% of emissions (Obunwo and Braide, 2013).

Effects of the Climate Change

Generally, the climate change effects have no bound. It affects both the environment and man. These could be seen in any developing economy such as: in the elevation of average annual temperatures (rising temperatures), intensity and seasonal nature of the rains (rising sea levels, change in dates of onset and end of the rainy season, reduced rainfall rate in some areas and increased rainfall rate in others) Flooding, erosion and increased intensity of the atmospheric disturbances like thunderstorms increased frequency of widespread, high impact weather phenomena including drought and flooding, Agriculture, Mass migration and insecurity, Education, Health, Loss of biodiversity, Desertification, Energy, industry, commerce and financial services, Coastal zones and Marine eco-systems and unemployment

Generally, the environmental effects of the climate change include rise in the sea level due to melting of the ice caps (Antarctica), change in dates of onset and end of the rainy season, reduced rainfall rate in some areas and increased rainfall rate in others leading to flooding, and increased intensity of the atmospheric disturbances like thunderstorms. Climate change affects all aspects both the rich developed economies and the poor or underdeveloped economies of the world. However the underdeveloped economies such as Nigeria are the most vulnerable to these effects.

There has been an increase in amount of the rains and number of rainy days. This is because climate change affects the surface water level that is established by rainfall and the glacial melting. Rainfall is by far the most important element of climate change in Nigeria and water resources potential in the economy (Adejuwon, 2004). The northeast region of Nigeria is increasingly becoming an arid environment at a very fast rate per year occasioned by fast reduction in the amount of surface water, flora and fauna resources on the land. Consistent reduction in rainfall leads to a reduction in the natural regeneration rate of land resources. This makes people to exploit more previously undisturbed lands leading to

depletion of the forest cover and increase on sand dunes/Aeolian deposits in the northern axis of Nigeria. The southern area of Nigeria largely known for high rainfall is currently confronted by irregularity in the rainfall and temperature is gradually increasing in the Guinea Savannah zone of the country; while the northern zone faces the threat of desertification.

Rising Temperature

The release of destructive gases by human action which in turn brings about the warming of the earth surface results to increase in the earth's temperature. Nigeria daily temperature average differs according to location and period of the year. Nigeria average temperature ranges from 25^0C in the south coast to 40^0C in the north. A rise in temperature of between 1.4^0C to 5.8^0C by 2010 according to Intergovernmental Panel on Climate Change, (IPCC), and will have serious negative effects on the socio-economic wellbeing of the country (IPCC, 2007). The increase in temperature in turn causes the melting of ice which contributes to the rise in sea level among other disastrous consequences.

Loss of Biodiversity

Extreme temperatures (low or high) due to climate change do not favor biodiversity. Hence they are lost by the impact of the climate change in any developing economy.

Flooding

Flooding which is as a result of rising sea level is very common along Niger River through Benue basin and Sokoto basin, and this affects agricultural land use to a great extent. Many of the country's larger rivers have flood plains, which are subject to flooding during the rainy season. These include the Rivers Niger, Benue, Cross River, Kastina, Imo, etc.

Urban flooding occurs in towns located on flat or low lying terrain (coastal areas) especially where little or no provision has been made for surface drainage, or where existing drainage has been blocked with municipal waste, refuse and eroded soil sediments. Nigerian towns are generally characterized by poor drainages and are therefore subject to flooding. Particularly affected are such towns as Lagos, Ibadan, Aba, Calabar, Maiduguri, PortHarcourt, etc. An estimated 25 million people or 28% of Nigeria's population live in the coastal zone and are at risk from flooding (NEMA, 2012). The areas that received several flooding impacts include the coastal areas of Lagos, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom and Cross River States. Lagos Bar Beach distance from adjacent road was 1,500m in 1964, became 200m in 1974 and has now taken over the road as at last nineties); claims 30-40m land annually (NEMA, 2012).

Coastal Erosion is another direct cause of rising sea level and seasonal nature of the rains. Coastal erosion is experienced in almost all the sections of the country's coastal zones. The social and economic consequences of coastal erosion can be substantial in many cases. It may cause displacement of a whole community, including the loss of lives as the case with Ogulaha community in Forcados south point, Delta State, entire Bayelsa community etc. the consequences reflected in the loss of lives and properties could be quite severe, especially in Delta State where the coastal zone contributes to a major part of the nation's income.

Drought is another effect of rising sea level. The major areas that typically receive very severe drought impacts are areas within the Sudan/Sahel belt. These include areas north of latitude 110^0N comprised of Borono, Yobe, Adamawa, Taraba, Sokoto, Bauchi, Gombe, Kebbi and Zamfara states.

Agriculture

The agricultural sector contributes some percentages of the Nigerian Gross National Product and majority of the rural populace are employed in this sector. The agricultural sector has a multiplier effect on any nation's socio-economic and industrial fabric because of the multifunctional nature of the sector (Ogen, 2007). Many African countries which have their economies largely based on weather-sensitive agricultural production systems like Nigeria are particularly vulnerable to climate change. This vulnerability has been demonstrated by the devastating effects of recent flooding in the Niger Delta region of the country and the various prolonged droughts that are currently witnessed in some parts of Northern region. Thus for many poor countries like Nigeria that are highly vulnerable to effects of climate change, understanding farmers response to climatic variations is crucial, as this will help in designing appropriate coping strategies.

Again, the dominant role of agriculture makes it obvious that even minor climate deteriorations can cause devastating socio-economic consequences. However, the World Bank survey has listed Nigeria and 15 other oil producers, as countries that have progressively reduced gas flaring. Following the Kyoto-Protocol is a double edged sword for Nigeria; the probable positive long term effects on the climate change are opposed to the negative short term effects for the economic development. Observing the Kyoto-Protocol would reduce the income of the OPEC-States, amongst them Nigeria, about 25% until 2010 (World Bank, 2010). This would be a catastrophe for the Nigerian development agenda.

In the arid zones, droughts are getting worse and climate uncertainty is growing, climate change is an unprecedented and threat to food security. Arid and semi-arid areas in the northern Nigeria are becoming drier, while the southern part of the country are getting wetter, global warming means that many dry areas are going to get drier and wet areas are going to get wetter. They are going to be caught between the devil of drought and the deep blue seas of floods. More so, "great tragedy" and Nigeria had played virtually no role in global warming; a problem was caused by economic activities of the rich, industrial countries. Unless climate change is tackled by all the "best efforts" to help this great country could come to nothing.

Education

Climate change effect could lead to total migration of the entire population. In this regard people leave their place of abode to another, schools are deserted, children do not go to school and the educations of such people are affected.

Weather

Environmental degradation and attendant desertification are major threats to the livelihoods of the inhabitants of the frontline states of Nigeria. This leads to increasing population pressure, intensive agricultural land use, overgrazing, bush burning, extraction of fuel wood and other biotic resources. Women and children are particularly the most vulnerable to the impacts of climate change. Climate change is really of great concern to our nation.

Mass Migration and Insecurity

This is another effect that has been triggered off by climate change. This migration is usually on a very large scale as their basic living conditions have been influenced as a result of climate change. The movements are usually from rural to urban or from one rural community to another, as a result of the need to maintain constant or old life styles in a new environment. Others may move from rural areas where agrarian life styles have been overwhelmed by climate change, into urban centers to search for better livelihood options. Others may even cross borders hoping that the new environment will

bring better prospects. In most situations such migration benefits the people as well as the community or country in which they find themselves. Experience from tickly populated areas like Lagos shows that such migration creates other environmental problems such as pollution, overcrowding and some health effects. The migration could also cause some insecurity for the people especially for the women and children.

Health

Over population would lead to uncontrolled disposal of wastewater and human wastes which will result to the deterioration of the environment. This could lead to high organic levels in surface and underground water thereby increasing epidemic of water borne diseases such as cholera, hepatitis, typhoid and malaria. Displaced populations will lose their jobs, children will no longer go to schools, the women and young girls are exposed to rape at the camp, they are exposed to unwanted pregnancy which is detrimental to their health. They lack food and good drinking water hence could be exposed to mal nutrition which could lead to death of the young ones (Isife, 2012).

Energy, Industry, Commerce and Financial Services with respect to energy, it is a two-way vulnerability for Nigeria. First, Nigeria is vulnerable to the adverse impact of climate change through high electricity demand for heating, cooling, and pumping water; reduced availability of hydroelectricity and fuel wood; and extensive damage on petrochemical industrial installations presently concentrated in the coastal belt. Inadequate supply of power could force closure of many industries thereby rendering several Nigerians jobless. This in turn will aggravate the country's existing macroeconomic problems of unemployment. Products from such industries become unavailable and where available through importation, the prices are beyond what an average an average Nigerian can afford.

The numerous industries clustering around Nigeria's seaports are seriously threatened by sea level rising. Most petrochemical industrial installations are concentrated along the coastal zones as offshore and onshore installations in the country. Accelerated sea level rise associated with climate change posse significant threat to all these installations. Hence, in an event of extreme climate change hazard of sea level rise, not only will lives be lost, irreparable damage would occur in all the country's oil installations due to the rising ocean waves.

Pests and Diseases are implicated in the climate change. Significant climatic conditions such as temperature, precipitation, sunshine and wind can affect and accelerate their dispersion and their increase. Food crops are affected by their presence creating economic problems because of low agricultural yields, hence, food shortages arise. Pest and diseases can adversely affect animal husbandry; it also cause human suffering such as typhoid and dengue fever, cholera, malaria and others; which in turn affects the effectiveness and productivity of the Nigerian labour force (Isife, 2012).

Sustainable Development

The concept of sustainable development has taken over that of development since development should be continuous. Environment is in continuous change through natural and man-made activities that can hinder sustainable development in Nigeria. Sustainable development can be achieved by inculcating dynamic environmental education through creativity and innovation in the educational system for the society to be re-positioned to protect the ecosystem and for the preservation of the environment for the future generation. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Todaro and Smith, 2011). Sustainable development implies economic growth together with the protection of environmental quality.

RECOMMENDATIONS ON THE MITIGATING MEASURES

However, to curtail, or palliate the adverse effects of climate change in a developing economy such as Nigeria, it is recommended that Nigeria should undertake the following actions within some sectors:

Agriculture: Adopt improved agricultural systems for both crops and livestock. For example diversify livestock and improve range management; increase access to drought resistant crops and livestock feeds, adopt better soil management practices and provide early warning/ meteorological forecasts and related information.

Implement strategies for improved resource management. This could include the increase in the use of irrigation system that use low amounts of water, increase rainwater and sustainable ground water. Initiate a national programme for integrated water resource management at the watershed level, harvesting for use in agriculture; increase planting of native vegetation cover and promotion of re-greening efforts and intensify crop and livestock production in place of slash and burn. Focus on agricultural impact in the savannah zones, particularly the Sahel, the areas that are likely to be most affected by the impacts of climate change.

Freshwater Resource, Coastal Water and Fisheries

Intensify programs to survey water quality and quantity for both ground and surface water.

Implement programmes to sustainably extend and improve water supply and water management infrastructure. Explore water efficiency and management of water demand, particularly in Sahel and Sudan savanna areas.

Forests: strengthen the implementation of the national Community-Based Forest Resource Management programme. Tree planting is very paramount in order to capture CO² in the atmosphere. Support review and implementation of the National Forest Policy. Develop and maintain a frequent forest inventory system to facilitate monitoring of forest status; and initiate a research programme on a range of climate change related topics, including long term impacts of climatic shifts on closed forests. Establishment of forest guards to protect the natural forests, plantations and nurseries, and implement low logging practices.

Biodiversity; support the active implementation of the National Biodiversity strategies and Action Plans (NBSAP), particularly those strategic actions that address climate change impacts.

Support recommended climate change adaptations policies and programmes in sectors that affect biodiversity conservation, including agriculture, forestry energy and livelihoods.

Health and Sanitation; undertake research to better understand the human health impacts of climate change in Nigeria. Strengthen disease prevention and treatment for those diseases expected to increase as a result of climate change. Reinforce programmes to build and maintain waste water and solid waste management facilities.

Establish early warning and health surveillance programme as well as adoption of practices and technologies that reduces exposure and health impact of extreme heat.

Human Settlement and Housing; develop climate change adaptation action plans for urban areas, particularly those at great risk. Assist communities to reduce vulnerability through participatory planning of land use and housing. Discourage building /urban encroachment into vulnerable areas, high risk zones and low lying areas. Discourage housing and settlement practices that are maladaptive in the face of climate change. Strengthen rural areas in order to reduce rural

urban migration.

Energy; include increased protective construction and placement of energy infrastructure. Undertake risk assessment and risk reduction measures to increase the flexibility/ resilience of the energy sector. Expand sustainable energy sources and decentralize transmission in order to reduce vulnerability of energy infrastructure to climate change.

Industry and Commerce; this will increase knowledge and awareness of climate change risks and opportunities. Undertake and implement risk assessments and reduction measures. Incorporate climate change into ongoing business planning. Promote and market emerging opportunities from climate change.

Education: provide evidence-based information to raise awareness and trigger climate change adaptation actions that will protect present and future generations in Nigeria.

Train teachers on climate change adaptation teaching strategies and techniques at pre- primary, primary, secondary and tertiary levels of education in Nigeria.

Develop skills-based curriculum in subjects like science, geography, social studies, language arts, environmental education and technology that will empower children to better respond to the threats of climate change.

Livelihoods; develop a replicable approach/ model that uses intermediate NGOs community members and radio to diffuse climate change adaptation approaches and information and to gather feedback on adaptation actions focused on livelihoods. Animate communities with appropriate engagement methods, in order to elicit and document valid climate change and livelihood related needs/vulnerabilities.

Government should improve their financial status towards the solution of findings from researches on these issues. Inadequate funds hamper progress in achieving Nigeria's objectives on climate change mitigation. The Nigerian government and all the stakeholders involved in the global phenomenon needs to increase public awareness, promote research and establish a commission or an agency that will handle issues related to global warming and climate change. The federal, state and local Government, international agencies and other development partners are required to fund climate change projects in Nigeria for sustainable solutions.

CONCLUSIONS

However, given due consideration to the above recommendations, the developing economy such as Nigeria would consolidate its present efforts towards mitigating the effects of climate change and reaffirms its commitment towards ensuring and adopting healthy, friendly strategies to adapt to the climate change challenges for sustainable development.

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